



ENVIRONMENTAL CONSIDERATIONS FOR EXERCISE



Adapted from (ACSM)
American College of Sports Medicine

Excessive heat, humidity, cold, and air pollution change resting, physiological state and its responses to exercise. **Heat and humidity impose the greatest environmental stress.**



HEAT AND HUMIDITY



- ✦ Exercise in thermally hostile conditions can imperil the ability to properly thermoregulate.
- ✦ Prolonged exposure results in a gradual increase in core body temperature, which inevitably results in heat illness, sometimes with devastating consequences.
- ✦ Exercise recommendations: Focus on avoidance of the adverse environmental conditions and adequate hydration.

WET BULB GLOBE TEMPERATURE (WBGT)

- ✦ An index of environmental conditions.
- ✦ Independent on air temperature, humidity, radiant heat from the sun, and wind speed.
- ✦ Provides an index of relative risk for heat injury.



HEAT ILLNESS

HEAT CRAMPS

- ✦ Not life threatening
- ✦ May result from dehydration

DEHYDRATION

- ✦ Result of excessive sweating and may be a precursor to heat injury.
- ✦ Water loss of as little as 1.5% of total body weight can decrease exercise performance.

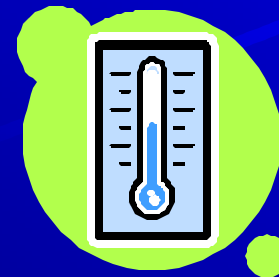


HEAT EXHAUSTION & HEAT STROKE

- ✦ Are health and life-threatening conditions that result from a combination of metabolic heat generated during exercise accompanied by dehydration and electrolyte loss from sweating.

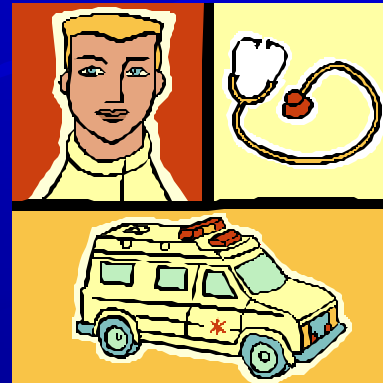
SIGNS & SYMPTOMS

- ✦ Uncoordinated gait, headache, dizziness, vomiting, and elevated body temperature.



FIRST AID FOR HEAT EXHAUSTION & HEAT STROKE

- ✦ Discontinue exercise.
- ✦ Place the person in the supine (on back) position with feet elevated.
- ✦ Rehydrate the person immediately.



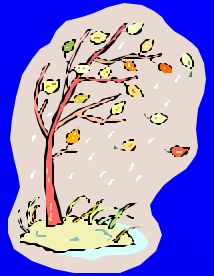
PREVENTION OF HEAT PROBLEMS

- ✦ Acclimatizing properly (10-14 days).
- ✦ Exercising during cooler parts of the days.
- ✦ Reducing the duration and intensity or discontinue exercise of WBGT > 88 degrees Fahrenheit.
- ✦ Hydrating liberally before, during, and after exercise.



ACUTE COLD EXPOSURE

- ✦ Normally does not pose a significant health risk.
- ✦ Exercise generates metabolic heat that warms the body.
- ✦ Clothing can be used to help retain heat.
- ✦ Exercise performance is not significantly reduced in a cold environment.
- ✦ Cold injury can occur during exercise in a cold and windy environment.



TYPES OF COLD INJURY

Hypothermia

- ✦ Potentially life threatening condition
- ✦ Occurs when metabolic heat production cannot compensate for heat loss to the environment, resulting in a gradual decrease in core temperature.

TYPES OF COLD INJURY (CONT)

Frostbite

- ✦ Results from water crystallizing within tissues, with subsequent destruction of that tissue
- ✦ Generally occurs when skin is exposed or insufficiently insulated.

MORE COLD INJURY INFORMATION



- ✦ Cold air generally does not usually damage lung tissue, because inspired air is warmed adequately in the upper airways before reaching lungs. Inhalation of cold air may provoke anginal pain in symptomatic cardiac patients or others with coronary artery disease.
- ✦ Prevention of cold injuries requires a balance between exercise intensity and the insulating effect of protective clothing.



ALTITUDE



- ✦ Altitudes as low as 3000 feet can impose physiological limitations on the human body.
- ✦ With increasing altitude, barometric pressure decreases along with decrease in partial pressure of oxygen (PO_2).
- ✦ A lower PO_2 makes it more difficult for oxygen to move from the air (alveoli in lungs) into the blood (hemoglobin molecule), resulting in reduced oxygen saturation (SaO_2) of the blood.

ALTITUDE CONTINUED

- ✦ Consequently, less oxygen is available for delivery to working tissue resulting in a reduced physical work capacity.
- ✦ Physiological consequences include an elevated Heart Rate (HR) at rest and during exercise.
- ✦ Because VO_{2max} decreases at altitudes above 3000 feet, all submaximal tasks become relatively more difficult.
- ✦ Acclimatization occurs gradually and is usually complete within 2 weeks.



MEDICAL PROBLEMS AND HIGH ALTITUDE EXPOSURE

Acute Mountain Sickness (AMS)

- ✦ Common signs include dehydration, severe headache, nausea and other gastrointestinal problems, decreased appetite, and insomnia.
- ✦ If AMS is not partially resolved within 2-3 days, descent is recommended.

Hypothermia

- ✦ Frequently compounds altitude problems.



MEDICAL PROBLEMS AND HIGH ALTITUDE EXPOSURE (CONTINUED)

- ✦ High-Altitude Pulmonary Edema (HAPE)
- ✦ Although rare, it can be life threatening if not attended to immediately.
- ✦ Onset may be subtle, with signs including dyspnea (difficult or labored breathing), fatigue, chest pain, tachycardia (rapid heart beat), coughing, and cyanosis.
- ✦ Immediate descent to lower altitude is essential.





PREVENTION OF HIGH-ALTITUDE SICKNESS



- ✦ Avoidance of alcohol and caffeine containing beverages helps protect against dehydration.
- ✦ Liberal fluid intake should be encouraged to offset the fluid loss that occurs through hyperventilation, urination, and sweating.
- ✦ A high-carbohydrate diet helps maintain hydration and provides necessary energy for muscular work.



PREVENTION OF HIGH-ALTITUDE SICKNESS (CONTINUED)

- ✦ Unacclimatized persons should avoid vigorous exercise during early exposure to high altitude.
- ✦ Training Heart Rate prescribed at sea level apply to high altitude.
However, exercise pace (i.e., running speed) will be reduced.



AIR POLLUTION



- ✦ Is a health risk and can reduce exercise tolerance.
- ✦ May cause a bronchoconstriction and increased airway resistance.
- ✦ Reduced oxygen carrying capacity may occur due to competition for hemoglobin binding sites between oxygen and pollutants, particularly when concentrations of carbon dioxide are high.

AIR POLLUTION (CONTINUED)



Persons at Risk

- ✦ Persons with reactive airways are usually most affected by atmospheric pollutants.

Exercise Modifications

- ✦ Avoid high pollution levels by both timing and place of exercise.
- ✦ Carbon Monoxide levels in cities are usually highest during rush hours.
- ✦ Ozone levels are usually lowest in winter and peak during afternoon hours in the late summer and early fall.

COMBINED ENVIRONMENTAL FACTORS

- ◆ Combinations of cold air, altitude, and air pollution may present significant limitations for exercise, particularly in those with Exercise Induced Asthma (EIA).



REFERENCE

- ◆ American College of Sports Medicine (ACSM). (2001). ACSM's Health & Fitness Certification Review.

